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ABSTRACT

The purpose of this study was to devise an instructional model accommodating students' learning styles in the following areas: sound, light, temperature, design, and mobility. Specifically, this study determined if students in an experimental group with environmental accommodations to their preferred modes of learning differed from students in a control group without such accommodations in grades earned in reading, mathematics, and language. Subjects were 158 second graders from three schools. The Learning Style Inventory-Primary was administered to students in the experimental group to determine their preferred modes of learning. Experimental group teachers modified the learning environment of each student in the experimental group in accordance with his or her unique learning style. Results indicated that although the experimental and control groups did not differ prior to the beginning of the treatment in grades earned in reading, mathematics, and language, tests during treatment showed that students in the control group received significantly higher grades in mathematics and language. These results raise serious questions about accommodating individual differences in learning styles using the instructional modes employed in this study. (SH)

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EFFECTS OF LEARNING STYLE ACCOMMODATION ON ACHIEVEMENT OF SECOND GRADERS

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Abstract

The purpose of study was to devise, to implement, and to evaluate an instructional model accommodating students' learning styles in the following areas: sound, light, temperature, design, and mobility.

Experimental and control groups were randomly selected from second-grade classes in three schools. The Learning Style Inventory-Primary was administered to students in the experimental group to determine their preferred modes of learning. Experimental group teachers were trained to implement the learning style accommodations. For 12 weeks, they modified the learning environment of each student in the experimental group in accordance with his/her unique learning style.

Multivariate and univariate analyses of variance conducted to determine if the experimental and control groups differed before treatment on prior grades in reading, mathematics, and language revealed no significant differences. Tests of group differences on grades earned during treatment yielded a significant MANOVA. The follow-up ANOVAs showed that the groups differed significantly on grades in mathematics and language but not in reading. The students in the control group received significantly higher grades in mathematics and language. These results raise serious questions about accommodating individual differences in learning styles using the instructional model employed in this study.

EFFECTS OF LEARNING STYLE ACCOMMODATION ON ACHIEVEMENT OF SECOND GRADERS

Society's perception of education has changed dramatically in the past 50 years. Established practices of teaching and scheduling made the American educational system both successful and relatively well-respected during the first half of the century. Thus, schools and teachers were revered by the community, and any student who failed to learn did so because he or she failed to try with much diligence. Therefore, the blame fell on the student, not the teacher. Today, however, low achievement is directly blamed on the schools, teachers, and instructional programs (Dunn & Dunn, 1978).

According to Warner (1982), although some redundant and unnecessary experimentation was conducted in the 1970s, two important distinguishing characteristics of human learning have emerged: the diagnosis and treatment of individual learner differences and the management of the learning environment. Gregorc (1982) made a similar statement when he stated that

> education is making an insufficient impact on the human potential for learning. A primary contribution factor is our fragmented view of instruction. . . [and] learning style research has the potential to serve as a framework that could put the various facts and psychologies into a perspective and thereby lead us toward becoming a unified profession. (p. 31)

Keefe (1982) asserted that as society changes and costs increase, research on learning styles is becoming increasingly significant and that the key to effective schooling lies in understanding the range of student learning styles and designing appropriate materials that respond directly to the needs of the individual learner.

Ross (1980) pointed to the emerging understanding of how students with different styles function in various teaching-learning situations to form positive attitudes toward learning and promote a sense of satisfaction.

Learning styles can be defined as the "range of instructional strategies through which students typically pursue the act of learning" (Smith & Renzulli, 1984, p. 45). Because "most children can master the same content, how they master it is determined by their individual styles" (Dunn, Beaudry, & Klavas, 1989, p. 55).

Research by Rita and Kenneth Dunn (1978) yields at least 18 categories that, when classified, suggest that learners are affected by their immediate environment, their own emotionality, their sociological needs, and their physical needs. Further research corroborates that children learn more material more easily and retain more when they are taught through their preferred learning styles (Cafferty, 1980; Carbo, 1980; Domino, 1970; Douglass, 1979; Farr, 1971; Krimsky, 1982; Pizzo, 1981; Shea, 1983; Tannebaum, 1982; Urbschat, 1977; White, 1981).

Earlier research supports the accommodation of learning styles within the classroom. James (1962) and Pascal (1971), for example, provide support to a student-based instructional approach, pointing to the findings that educational outcomes are enhanced by giving students the opportunity to evaluate their learning style preferences and by allowing them to learn in their preferred mode of instruction. From the perspective of learning style, one major educational objective is to teach students how to learn and to manage their selection and use of various learning style strategies (Derry & Murphy, 1986). The accommodation of learning styles within the classroom can be a basis for providing instruction responsive to the needs of those being served. This clientele, of course, includes an increasingly diverse student population (Dunn et al., 1989.

Nowhere is this point more well expressed than by Mackinnon (1978):

> The wide range of individual differences surely must mean that there is no single method for nurturing creativity; ideally, the experiences we provide should be tailor-made, if not for individual students, at least for different types of students. We should remember that the same fire that melts the butter hardens the egg. (p. 171)

Teachers are relatively receptive to the concept of learning style accommodation within their classrooms because students

achievement can be improved (Dunn & Dunn, 1987;). As Jeter and Chauvin (1982) noted:

> Educators are keenly aware that each student possesses unique needs, interests, and abilities, and that each child should have an opportunity to pursue an effective instructional program at a pace that is challenging and interesting. (p. 2)

Administrators, on the other hand, are receptive to innovation only if proposed change does not prove too costly in terms of funding, special training, and equipment.

Thus, the purpose of this study was to devise a practical, easily implemented, relatively inexpensive learning style model which accommodated students' learning styles in the following areas: sound, light, temperature, design, and mobility. More specifically the purposes of this investigation were to determine if students in an experimental group where environmental accommodations in areas of sound, light, temperature, design, and mobility differed significantly from students in a control group where no such accommodations were made in the learning environment on grades earned in reading, mathematics, and language. A further objective was to determine if the experimental manipulation was differentially effective for males and females and for black and white students.

According to Dunn (1987), research supports the importance of complementing the individual's learning style preferences with congruent instructional environments of sound, light, design,

time-of-day, mobility, and temperature. Even though the time-of-day element was omitted because of scheduling conflicts which would arise within the classrooms being used, the previously cited research studies and theoretical formulations would cause one to hypothesize that altering the environment would have a positive effect upon students' grades in reading, mathematics, and language. The Center for the Study of Learning and Teaching Styles of St. John's University of New York suggested beginning with a few of the learning styles delineated in the Learning Style Inventory-Primary by Dunn and Dunn (1987) and building upon those identified to increase the achievement level of the members of the group.

Method

Subjects for this quasiexperimental investigation were 158 second graders in the Randolph County (AL) school system. Within each school were at least two sections of second grade, and students had been assigned to sections on a random basis with an equal distribution of students in each section. Within each school the two classes were randomly assigned to experimental and control groups with the assistance of the school's principal.

The students in the experimental groups were administered the Learning Style Inventory-Primary by a counselor within the school system. The principal investigator scored the inventories and devised a list for each teacher indicating preferences for any of the areas of sound, light, temperature, design, and mobility of the students listed on the teacher's class roll.

Teachers of the experimental groups were then instructed to allow students to move to preferred areas of the room while doing seatwork in reading, mathematics, and language. Students preferring sound were fitted with headphones; students preferring warmth were seated in warmer areas of the room; students preferring bright light were seated in brightly lit areas of the room; and students preferring mobility were allowed to take brief walks in the classroom while completing seatwork. Conversely, students preferring no sound were seated in quiet sections of the room; students preferring cooler environments were seated in cool areas of the room; students preferring dim light were seated in areas of the room where less light was emitted from the fixtures; and students who did not express mobility as a preference were allowed to sit for longer periods of time.

Measures of light and temperature were made more accurate with the use of thermometers and the measurement of footcandles emitted by the light fixtures in certain portions of the classrooms. Teachers were informed of these designated areas, and they then placed students according to student preferences while students did their assigned seatwork in reading, mathematics, and language.

Students and teachers in the control groups were provided no special instructions, but the teachers were informed that they were to continue teaching just as they usually did.

Learning style accommodation commenced at the beginning of the fourth 6-weeks grading period and continued through the fifth 6-weeks.

The teacher-assigned grades in reading, mathematics, and language arts were recorded for each student in the experimental and control groups for each of the six grading periods of the school year. These were designated from an A+ as 13 to an F as 1. In addition the age, sex, and race of each child were recorded as well as the school and group (experimental or control) to which the child belonged.

Results

Even though students were randomly assigned to classes and classes were randomly assigned to experimental and control groups, an initial test was conducted to evaluate group equivalence. The results of the multivariate test, MANOVA, of the differences in grades obtained before the treatment began revealed no significant pretest differences between the groups on grades in reading, mathematics, language, $F(3, 122) = .29$ $p = .83$.

Next, a 2 x 2 x 2 MANOVA was conducted to determine the effects of the treatment and the interactive effects of treatment condition and sex and/or race on the posttest grades earned in reading, mathematics, and language. In the overall MANOVA, Wilks' lambda was not found to be significant for any of the interaction combinations of treatment group by sex by race as can be seen in Table 1. Adhering to the general guidelines for the

MANOVA procedure regarding significance, further interpretation

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Insert Table 1 about here

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of the interactions at the univariate level was not appropriate.

There was a significant main effect for treatment group in the MANOVA, $F(3, 148) = 3.05$, $p = .03$. Follow-up univariate analyses of variance (ANOVAs) for the three dependent variables are presented in Table 2. Significant univariate F values were found for grades in language F (1, 150) = 5.92, $p = .02$, for

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Insert Table 2 about here

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grades in mathematics $F(1, 150) = 7.15$, $p = .01$, but not for grades in reading $F(1, 150) = 2.89$, $p = .09$. Subjects in the control group scored significantly higher ($M = 27.97$) than subjects in the experimental group ($M = 23.09$) on grades earned in mathematics. Further, subjects in the control group scored significantly higher ($M = 27.10$) than subjects in the experimental group ($M = 23.65$) on grades in language. The control group mean ($M = 25.61$) was not significantly higher than the experimental group mean ($M = 22.87$) on grades in reading.

Discussion

The results indicate that the experimental and control groups did not differ prior to the beginning of the treatment on grades earned in reading, mathematics, and language as would be

expected under conditions where subjects were randomly assigned to groups and groups were randomly assigned treatment conditions. What was not expected based upon the literature reviewed was that the control group would have significantly higher grades in mathematics and language. What are some possible explanations for such an anomaly? One possible explanation is that the accommodations of the learning environment involving moving students around for lighter, darker, cooler, warmer, noisier, quieter work areas were actually disruptive and negatively impacted student achievement of teacher classroom objectives in mathematics and language. It may be that had the accommodations been employed during instruction and for longer periods of time significant results favoring the intervention might have been found. Another possibility is that the Dunn and Dunn model is of questionable educational value.

Whatever the explanation, results of this study cast doubt on the benefit of such accommodations and suggest that educators should conduct further study before implementing interventions no matter how popular the package. While, no doubt, there are environments in which learning is maximized, it just may be that some of the most highly touted interventions may not be the most sound educationally. What happens in the classroom should be based on significant research. That more research is necessary before learning style accommodations be made is the major conclusion of this study. If the research does not support the

learning style interventions, then they should not become classroom practice.

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Table 1

Multivariate Analysis of Variance Effects of Interaction, Treatment, Sex, and Race on Post-Treatment Grades in Reading, Mathematics, and Language.

Source	Wilks' lambda	Hypothesis *df*	Error *df*	*F*
Group(A)	.94	3	148	3.05*
Sex (B)	.87	3	148	7.42**
Race (C)	.97	3	148	1.68
A x B	.98	3	148	.96
A x C	.99	3	148	.21
B x C	.98	3	148	1.06
A x B x C	.99	3	148	.86

* $p < .05$.

** $p < .001$.

Table 2

Factorial Analysis of Variance of Effects of Treatment, Sex, Race, and Their Interactive Effects on Grades in Reading, Mathematics, and Language

Source	df	SS	MS	F
		Reading		
Group (A)	1	331.31	331.31	2.89
Sex (B)	1	1322.53	1322.53	11.55 ***
Race (C)	1	297.50	297.50	2.60
A x B	1	322.26	322.26	2.81
A x C	1	.94	.94	.01
B x C	1	10.74	.09	.76
A x B x C	1	54.56	.48	.49
Error	150	17173.51	114.49	
Total	157	19504.26		
		Mathematics		
Group (A)	1	946.51	946.51	7.15**
Sex (B)	1	1701.95	1701.95	12.86***
Race (C)	1	631.17	631.17	4.77*
A x B	1	145.15	145.15	1.10
A x C	1	.01	.01	.00
B x C	1	145.53	145.53	1.10
A x B x C	1	89.52	89.52	.68
Error	150	19846.16	132.31	
Total	157	23367.72		

Table 2 continued

Factorial Analysis of Variance of Effects of Treatment, Sex, Race, and Their Interactive Effects on Grades in Reading, Mathematics, and Language

Source	df	SS	MS	F
		Language		
Group (A)	1	579.65	579.65	5.92*
Sex (B)	1	1947.68	1947.68	19.89***
Race (C)	1	304.96	304.96	3.12
A x B	1	244.60	244.60	2.50
A x C	1	23.06	23.06	.24
B x C	1	122.74	122.74	1.25
A x B x C	1	40.55	40.55	.41
Error	150	14685.26	97.90	
Total	157	17684.08		

* $p < .05$.

** $p < .01$.

*** $p < .001$.